Revista de Saúde Pública
ISSN 0034-8910 versão impressa

Rev Saúde Pública 2003; 37(5)

PSA and anthropometric measurements among Amazon Indians: an evaluation of the Parkatejê community

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ABSTRACT

Objective

PSA (prostate-specific antigen) screening for early detection of prostate cancer in a native community is of great epidemiological importance. The present study was conducted with the objective of verifying the occurrence of prostate cancer among members of an Amazon community, as well as its possible relationship to acculturation and overweight (body mass index).

Methodology

Lifestyle and anthropometric information was collected from a group of 22 men, presumedly over age 50, members of an isolated community of 363 Amazonian Indians – self-denominated Parkatejê and Kykatêjê – from Pará state, in Northern Brazil. In addition to physical and hematological exams, total and free PSA dosages were performed.

Results

Total PSA serum levels ranged from 0.35 to 25.8 ng/ml. Three subjects had PSA levels greater than 4.0 ng/ml, and another two had levels between 2.5 and 4.o ng/ml. Prostatic biopsies performed on two subjects indicated the presence of prostate adenocarcinoma in one of them and of intraepithelial neoplasia on the other. Overweight (BMI =25 Kg/m²) and waist-to-hip ratio =0,9 were observed in 68.1% and 72% of subjects, respectively.

Conclusions

Changes in nutritional habits caused by contact with civilization, such as the substitution of more caloric foods for the traditional game and vegetable fiber are increasing the prevalence of overweight among the community. In view of the association between prostate cancer incidence, high-fat diet, and less physical activity, it can be assumed that further cases of prostate neoplasia will occur in the future, since several community members already have high PSA serum levels.

Keywords

Prostatic neoplasms, diagnosis. Prostatic neoplasms, epidemiology. Prostate-specific antigen, diagnostic use. Body mass index. Indians, South American. Anthropometry. Risk factors. Obesity. Acculturation. Food habits. Prevalence.

INTRODUCTION

The discovery, in the last decades, of abnormal amounts of prostate-specific antigen (PSA) in the blood serum of patients with prostate adenocarcinomas caused a revolution in the approach to this disease. PSA is a protease of the kallikrein family, produced almost exclusively by the epithelium of the prostate gland, in order to solubilize sperm after ejaculation. Its level frequently increases during benign hyperplasias and prostatitis, and high serum levels can be observed in patients with prostate carcinoma. The importance of PSA dosage for clinical practice has caused it to become the most important resource for the early diagnosis and follow-up of prostate cancer patients. Its magnitude is such that prostate cancer is currently the most diagnosed internal cancer among men, PSA dosages identifying over 80% of new localized cases of this disease.[2]

Implications concerning the differences observed in serum PSA levels among African-Americans, whites, and Hispanics in a number of ethnic minorities have been the subject of debate for years.[5] Such differences may be connected to the biological differences among different ethnicities, and may account for variations in prostate cancer incidence. Could they be genetic determinants, with biological characteristics proper of each individual, or are they hereditary traits, which suffer environmental modification according to lifestyle and nutritional habits?

An important consequence of these phenomena is related to the three- to seven-fold increase in prostate cancer incidence among the first generation of Japanese-Americans whose parents migrated to San Francisco. The most convincing explanation, excluding the racial factor, was the change of environment, and especially the acquisition of new in nutritional habits, such as the ingestion of fat-rich foods.[1,2]

Differences in prostate cancer frequency among Alaskan-born Caucasians and Native-Americans have been well documented.[1,3,13] The present study is aimed at verifying the trend towards the appearance of prostate cancer and its possible relation to lifestyle and environmental factors among Amazon Indians. With this in mind, anthropometrical characteristics and serum PSA levels among this group were analyzed.

Methods

Twenty-two medical records of Parkatejê and Kikatêjê Indians, from the healthcare service for Indians maintained by the *Vale do Rio Doce* mining company were analyzed retrospectively. These natives belong to a *Timbira* tribe derived from the *Jê* language group. They live in the southeastern region of the state of Pará, in Western Amazon, in a reservation delimited as a result of the construction of the Carajás – Itaquí railroad, begun in 1980. The group comprises 363 Indians, whose nutritional customs and traditions had been preserved until then; these included game, fish, wild fruit, and roots. Since that time, the group has had intermittent and progressive contact with white civilization. Among these 363 natives, an anthropologist was able to identify 22 men presumedly aged 50 years or older. All of them allowed blood to be drawn for analysis, after an isolated case of acute urinary retention due to a benign prostate hyperplasia was identified and surgically treated at the University Hospital. In addition to the blood test, a simple physical examination was carried out, and anthropometrical measurements were registered in order to obtain body mass index (BMI), (normal <25 Kg/m²), and waist-to-hip ratio (WHR), (normal <0.9) measures. Biochemical dosages were carried out, including total blood PSA, through immunefluorescence. When this level was above 2.5 ng/ml, free/total PSA ratio was measured, (normal: 4.0 ng/ml and 0.72 ng/ml). Prostatic biopsies, under anesthesia, were indicated in case of free/total ratios below 15%, and subject to subject consent. Digital rectal examination could only be performed during biopsy.

RESULTS

PSA results are presented in Table 1. Total PSA values varied between 0.35 and 25.8 ng/ml. Three subjects had PSA levels greater than 4.0 ng/ml (5.33, 8.64, and 25.8), and another two between 2.5 and 4.0 ng/ml (2.6 and 3.2). In four of these the free/total PSA ratio was below 15%. Only two subjects consented to digital examination and biopsy. These revealed an adenocarcinoma nodule (Gleason score 3+2) in one subject and a high-grade intraepithelial neoplasm in the other. The patient with cancer is still under LHRH-analog treatment.

Table 1 - Age, total and free PSA values, and FPSA/TPSA ratio among natives aged 50 years or older.

Control	Age	Total PSA	Free PSA	FPSA/TPSA (%)
35	57	0.59		
36	68	1.3		
37	76	5.33	0.44	8.26
39	79	25.8	1.15	4.46*
40	56	0.85		
43	59	1.86		
44	58	8.64	0.36	4.17**
46	66	1		
47	59	0.31		
48	64	1.86		
51	56	0.66		
53	66	0.74		

57	62	2.42		
62	57	1.77		
63	56	2.6	0.37	14.23
66	70	1.06		
83	56	3.2	0.73	22.81
87	72	0.36		
91	70	2.03		
92	68	0.35		

*Biopsy with prostate adenocarcinoma.

**Biopsy with high-level intraepithelial neoplasia.

PSA – Prostate-specific antigen

TPSA –Total PSA

Anthropometric measurements, PSA results, and the correlations obtained between values for all 22 subjects are listed in Table 2. Despite the suggestive associations observed when comparing study population values, there were no statistically significant associations between Weight, (r=0.162843), BMI (r=-0.02416) and WHR (r=0.132533).

Table 2 – Age, weight, PSA values, body mass index, waist-to-hip ratio, p25, p75, and median value among natives aged 50 years or older.

Control	Age	Weight	Total PSA	BMI	WHR
35	56	67.4	0.59	25.66	0.891386
36	61	59.3	1.30	21.20	0.877944
37	78	71.5	5.33	24.74	0.986486
39	76	77.8	25.8	26.30	0.961620
40	58	64.1	0.85	26.01	0.898413
43	56	64.9	1.86	22.72	0.897778
44	57	72.1	8.64	26.16	0.948882
46	59	63.0	1.00	23.71	0.910006
47	64	65.5	0.31	26.57	0.936842
48	61	74.4	1.86	25.74	0.928866
50	78	60.0	0.41	24.50	0.936842

51	55	88.7	0.66	28.96	0.918041
53	58	82.9	0.74	26.61	0.949732
57	67	80.0	2.42	28.00	1.000514
58	78	76.8	1.51	28.55	1.000515
62	60	77.3	1.77	28.05	0.997925
63	58	80.4	2.6	27.48	1.003061
66	66	74.3	1.06	28.47	0.988855
83	61	59.3	3.2	22.86	0.881171
87	68	70.1	0.36	25.44	0.944206
91	73	69.4	2.03	23.19	0.893684
92	72	78.0	0.35	31.20	1.005130
p25			**0.68**	**24.56**	**0.901311**
p75			**2.3225**	**27.87**	**0.988263**
Median			1.405	26.085	0.940524

BMI – Body mass index

WHR – Waist-to-hip ratio

DISCUSSION

The first cancer-related studies among North-American indigenous groups demonstrated that stomach, intestine, rectum, prostate, and liver cancer incidences in this group were similar to those found among white Americans. Lung, breast, and bladder cancer, however, were comparatively rare among Native-Americans. Histological types were the usual, with the exception of bladder cancer, for which five in every eight cases were squamous cell carcinomas, and only three were transitional epithelium carcinomas.[3]

On the other hand, Gilliland[5] observed a strong difference in prostate cancer incidence and mortality between Hispanic and non-Hispanic whites, Native-Americans and African Americans in New Mexico. Although initial studies suggested that native North-Americans were at lower risk in comparison with non-Hispanic whites, more recent studies show that prostate cancer incidence and mortality rates are on the rise among this group, and are approaching those found among white population.[5] Such rise may be attributed to an increase in the detection of new cases. Nevertheless, this phenomenon remains a controversial one, since there is still the possibility of a real increase in the prevalence of this disease.

Historically, contact with civilization has resulted in progressive social and behavioral changes among indigenous peoples, discouraging them from seeking more natural foods and significantly altering their nutritional habits. These phenomena were followed by the appearance of diseases that are common among the general population, such as type II diabetes, chronic degenerative diseases, and cancer.[14] This new diet was identified as the likely culprit for the increase in prostate cancer incidence, observed between the 1968-72 and 1978-82 periods among Native-Americans from North Carolina.[9] Despite its possible causes being somewhat controversial, the association between this type of cancer and fat-rich diets had already been postulated at that time.[4,8]

In 1995, Whittemore et al,[15] in a study of the relationship of prostate cancer to diet, physical activity, and body mass in African-Americans, whites, and Asians living in the US and Canada, found a significant risk association between this neoplasia and total fat ingestion in all ethnic groups. This association was attributed solely to the excessive calories originated from saturated fats, and not to those related to protein or carbohydrates. At the time, risk was not associated with BMI or physical activity patterns. The authors suggested that other factors, in addition to saturated fat ingestion, could account for the different risk levels observed for the different ethnic groups. Recent studies with certain specific groups, however, have detected an important association between prostate cancer risk and BMI. Hsing et al[10] found an almost threefold risk (OR 2.71with 95%CI) among Chinese in the highest WHR quartile.

Generically, colon and prostate cancer risks can be positively correlated to a fat-rich diet; these tumors have a 50% higher chance of occurrence when compared to the risk found among individuals with normal diets. Likewise, fruit, vegetable, and legume ingestion is associated with lesser colon and lung cancer incidence.[1]

In addition to the nutritional aspect, a lifestyle including regular physical activity probably has a relevant role in this equilibrium, regulating individual necessities.[1,7] Thus the possibility to study a primitive community allows us to explore the role played by genetic factors and their expression in the unfolding of a disease, isolated form any influence of the habits of civilization. The study of the Parkatejê and Kikatêjê indigenous communities – which were submitted only recently the nutritional habits of white civilization – may reinforce such assumptions, since BMI and WHR analysis in this community revealed that 68.1% and 72.7% of natives over age 50 had results compatible with overweight. In the same line of thought, it can be assumed that the natives' traditional diet until two decades ago was related to a real and unknown occurrence of prostate cancer among that population. In the present survey, occurrence was one confirmed and one suspect case of sporadic cancer, the latter suffering from a high-degree intraepithelial neoplasm.

Researchers and anthropologists, when studying diet indications in ancient civilizations and the utensils of ancient times, believed that, in addition to foods of vegetable origin, such as cereals, fruit, and legumes, the wild meat of game was also low in fat.[7]

What actually occurred in the studied sample was that, since the reservation was established and the progressive contact with white civilization began, habits such as crystallized sugar, butter, margarine, beef, and sausages were introduced in the community. When the former equilibrium was disrupted, the first manifestation, or first abnormal indicator, observed was the appearance of overweight and diabetes cases. The high rates of cholesterol and triglycerides found have been attributed to the association of such habits with the reduction of the amount of physical activity.[14] If this scenario remains unaltered, it is likely that new cases of chronic diseases be introduced, such as non-insulin-dependent diabetes and certain types of cancer, including that of the prostate. Accompanying these groups will serve to reinforce the idea that the most important determinants of prostate cancer are a product of the interaction among environmental factors, and not primordially of the genetic alterations related to senility.[11]

Biologically, one of the explanations for this phenomenon may be the association with an increased resistance to insulin, observed in connection with physical activity reductions due to the decrease in hunting and food collection activities. In addition, recent observations indicate that prostate and breast cancer are associated to increases in IGF-1(insulin growth factor-1) levels, which may influence the proliferation of prostate-cancer cells.[6] It is possible that exercise, through the reduction of insulin resistance or IGF-1 levels, may play a role, modulating somehow the appearance of prostate cancer.

The presence of increased PSA levels in five out of 22 natives (23%) is similar to the prevalence found among the general white American population,[2] which suggests that the Pakatejê and Kikatêjê community is approaching the white population in terms of prostate cancer incidence. In other words, prostate cancer incidence does really increase when indigenous populations incorporate the habits of so-called "civilized" populations.

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Received on 30/6/2002. Reviewed on 28/4/2003. Approved on 3/6/2003.

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